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The rosette disease of blackberries and dewberries

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THE ROSETTE DISEASE OF BLACKBERRIES AND DEWBERRIES

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INTRODUCTION

Louisiana possesses many natural advantages for the development of an important blackberry and dewberry industry. It is already an established berry (strawberry) state with a long-standing reputation for good fruit. It has experienced growers for handling berries for shipment, and good and long-established shipping facilities. The earliness of its season might also make it possible to ship dewberries, and possibly blackberries, to the northern markets ahead of other sections and thus command satisfactory prices. It might thus be possible to prolong the shipping of berries from Louisiana by several weeks if the shipping of strawberries is followed by the shipping of dewberries and blackberries.

On the other hand, the industry will be confronted with many troubles in the form of diseases, both physiologic and parasitic. Among the former, winter-killing of canes is the most serious one. Because of the mild weather prevailing in the fall, the canes do not mature sufficiently to become dormant, and with the sudden onset of freezing temperatures in the winter, they are sometimes injured very considerably. The list of parasitic diseases includes crown gall, leaf spots, cane blights, rusts, and, the most serious of all, the **rosette** disease, which is the subject of this paper.

The rosette is by far the most important disease of blackberries and dewberries in Louisiana, and has been, in fact, the limiting factor to the establishment of a blackberry and dewberry industry in the state. The disease is wide-spread on the wild blackberries and dewberries. Some of the wild plants exhibit a certain degree of tolerance, but the cultivated varieties, when infected, become worthless in a very short time, usually by the end of the second year.

The disease has been under investigation during the last three years. These studies have resulted in the determination of the cause of the disease, the mode of infection, the period during which infection takes place, and in

the inauguration of measures of control, which, while still in the experimental stage, show promise of being very effective. The experimental data and a technical description of the causative agent of rosette will be presented in detail in a later publication of a technical nature. The present paper is non-technical and is intended primarily for the use of the practical grower.

DESCRIPTION OF THE DISEASE

The disease is very easily recognized by the rosette or witches-broom (bunchy, clustered) type of growth (Fig. 1) which appears on the affected

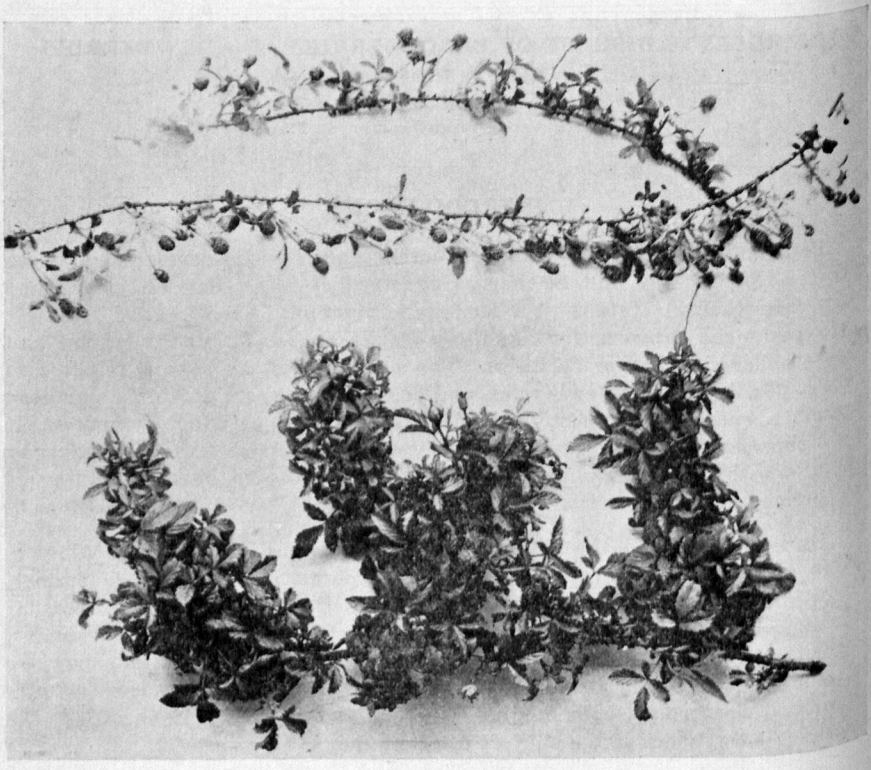

Figure 1

A. Upper: Two healthy canes.
B. Lower: Typically rosetted cane of the wild dewberry (**R. trivialis**). Note the lack of berries on the diseased cane.

canes in the spring. While healthy buds give rise to single shoots, the diseased ones produce multiple shoots, resulting in the formation of witches-brooms. The color of the rosette foliage, especially in the later stages, is lighter green than that of the healthy leaves, often yellowish-brown to bronze, so that the diseased canes of a vine may be easily seen from a distance. As a rule, the diseased shoots produce a large number of blossoms, although not infre-

quently the rosette growth may not produce any blossoms. The diseased blossoms are characteristically different from the healthy ones. The young, unopened healthy blossoms are round, tightly closed and compact (Fig. 2). The diseased ones, on the other hand, are elongated, puffed, larger in size than the healthy ones, and they are invariably sterile, never setting fruit (Fig. 2). The calyx parts enlarge, and often become "leafy". The petals are also larger and more pink than those of the healthy blossoms. Often the

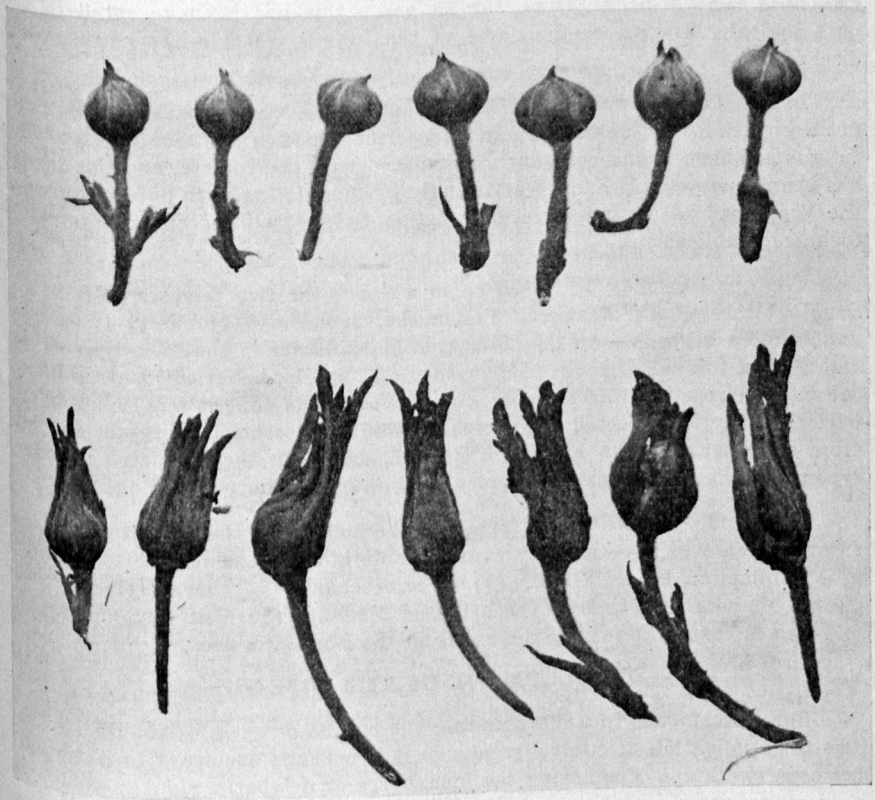

Figure 2

Contrast between healthy and rosette blossoms of the wild blackberry. Upper: Healthy blossoms. Lower: Rosette blossoms.

petals fail to unfold. The stamens do not develop fully, seldom reaching the stage when pollen is matured. After the blossoms open and begin to wither, the pistils and stamens become covered with a whitish, powdery, substance, which is made up of the mycelium and spores of the fungus that causes the rosette disease.

THE CAUSE OF THE DISEASE

Cook[1] in 1911, published an account of the "double blossom" of the dewberry and attributed the disease to **Fusarium rubi** Winter. Cook, apparently, did not attempt to classify the fungus, accepting Winter's[2] classification. In the same year, Reimer and Detjen[3], reporting on their work on double blossom in North Carolina, state that a culture of the fungus they found associated with the disease was sent to Cook who identified it as **Fusarium rubi** Winter. Thus, for 23 years this has been accepted in the pathological literature as the name of the fungus which is the cause of the disease.

In Louisiana, however, the fungus causing the rosette disease is distinctly not a Fusarium, but apparently an undescribed species of **Cercosporella.** This fungus has been found constantly associated with the rosette, and the disease has been repeatedly produced artificially by inoculating with pure cultures of the organism. A full description of this fungus will be given later in a technical publication.

The question may be raised as to whether the two diseases, rosette and double blossom, are identical. The author had the opportunity to see the double blossom disease on the cultivated blackberries in southern New Jersey and also on the wild blackberries in Virginia, and he believes that it is identical with the rosette. Furthermore, the **Cercosporella** fungus was isolated from wild blackberries affected with so-called double blossom in Virginia and also from specimens sent to him from Florida, and both these isolates produced typical rosette symptoms when inoculated onto blackberries in Louisiana.

The name "rosette" is preferred by the author for the following reasons: (1) it appears to have priority over "double blossom", since Norton[4] used it in a publication before Cook. (2) It is descriptive of the symptoms, while double blossom is not, since the affected blossoms are distinctly not double. (3) The disease is known by this name in the Louisiana area.

DEVELOPMENT OF THE DISEASE

For convenience in understanding the course or cycle of the disease and also the application of control measures it is perhaps necessary to distinguish between two kinds of canes on the blackberry or dewberry plant; namely, the new canes, or **primocanes,** and the old canes, or **fruit canes.** The primocanes arise from the crown during the current season. These do not bear fruit the first year. The fruit canes, which bear fruit this year, were produced the previous year, that is, they were last year's primocanes.

As stated above the spores of the fungus that causes rosette are produced on the diseased blossoms. These spores are scattered about by the wind and

[1]Cook, M. T. The double blossom of the dewberry (Fusarium rubi Winter). Delaware Agr. Exp. Sta. Bull. 93 (12 figures). 1911.

[2]Hedwigia. p. 258. 1885.

[3]Reimer, F. C. and L. R. Detjen. Double blossom of the dewberry and the blackberry. 34th Annual Report, North Carolina Agr. Exp. Sta. pp. 41-50. 1911.

[4]Norton, J. P. S. Rept. Maryland State Hort. Soc. 11 (1908): 78-81. 1909.

rain and possibly by insects. Those that happen to lodge on the buds of the young canes (this season's growth) germinate, producing tubes which penetrate the young buds and grow in the spaces between the embryonic elements of the buds. The fungus grows, and as new buds are formed by the infected ones, the fungus invades these also. Thus, it happens that, if infection has taken place in the terminal bud of a young cane, all the laterals that are formed after infection has taken place will be diseased; if, however, a lateral bud becomes infected, only the branch arising from this bud will be diseased. The infected canes grow normally during the summer and early fall, showing no external symptoms of being diseased until the following spring, when the infected buds will give rise to the rosette type of growth. Then the spores of the fungus will be produced on the blossoms arising from the rosette growth, and they will be ready to infect the new canes and repeat the cycle.

PERIOD OF INFECTION

The period during which infection takes place in Louisiana is rather limited. Infection occurs from about the middle of March, when the spores of the fungus begin to form on the diseased blossoms, until about the first half of June. Spores are present in great abundance on the withered blossoms as late as the end of August, but practically no infection takes place after the first week of June. This is very fortunate as it has permitted the use of control measures which would otherwise not be applicable.

The limits of the infection period have been determined by the following different tests:

1. **Inoculation Experiments:** From artificial inoculation of young canes with pure cultures of the fungus, as well as with spores from diseased blossoms, at different intervals from the first part of April to November, abundant infection was produced up to about the first week in June. Practically no infection resulted from the inoculations made during June, July, August and September. A small amount of infection resulted from the October inoculations. This, however, is of no significance from the practical standpoint, since no spores are present this late to produce natural infection.

2. **Spraying:** Spraying the young canes with Bordeaux at different periods showed that practically complete control of rosette was obtained when the canes were sprayed every ten days during April and May.

3. **Pruning:** The new canes (primocanes) were pruned to the ground at different intervals from April to July. Since infection has to take place on the new canes (this season's growth), this is a rather exact method of determining the period of infection. These tests showed that plants whose new canes were pruned to the ground after June 1st were entirely free of rosette the following spring, and that only a very small amount of the disease appeared on the plants whose new canes were pruned the middle of May. This indicates that infection did not take place naturally after about the 1st of June.

The experiments to determine the period of infection were made on the following species and varieties of blackberries and dewberries:

Wild	**Cultivated**
Blackberry **(R. rhodophyllus?)**	MacDonald
Dewberry **(R. trivialis)**	Lucretia
Dewberry **(R. sons)**	Young
	Crystal White

All of these behaved very similarly in respect to the period in which they are susceptible to infection, and the recommendations for control are based on the results of the experiments with these varieties and species. Of these, the MacDonald blackberry and the Lucretia and Young (Youngberry) dewberries show promise of becoming commercially important, especially the Young which is being planted somewhat extensively of late.

The reason for the limited period of infection has not been determined definitely. It is probably a question of temperature, since the period of resistance to infection corresponds to the hottest months in Louisiana, but other factors may operate.

EFFICACY OF BORDEAUX SPRAY

In 1931-32, before the nature of rosette or the period of infection had been determined, a spraying experiment was undertaken in order to see if the disease could be controlled by spraying. One very badly diseased planting of MacDonald blackberries and Lucretia dewberries was sprayed with 4-4-50 Bordeaux on the following dates: May 6, 13, June 10, 18, 29, July 21, August 4, 13, 28, September 8, 22, October 18, November 9, 23, December 11, January 8, and February 3, 10, and 18. Practically 100% control was obtained by this treatment.

In a second experiment the spraying was done late, on the following dates: October 22, November 5, December 3 and 22, January 16 and 28, and February 6. No control at all was obtained in this case.

These two preliminary tests showed that Bordeaux spray is effective in controlling rosette, but that late spraying has no value.

Later experiments have demonstrated conclusively that excellent control of the rosette can be obtained by keeping the new canes sprayed with Bordeaux during the last part of April and during May.

CONTROL

The method found effective in the northwestern states for keeping the double blossom disease under control is to prune the rosette growth as it appears on the fruit canes in the spring. While this method is very beneficial, for the pruning of the diseased growth as it appears in the spring eliminates the source of infection from the immediate vicinity of the plants, it is not sufficiently effective for the control of rosette in Louisiana where the disease is widespread on the omni-present wild blackberries. For Louisiana, more drastic remedial measures must be adopted.

Advantage was taken of the following factors in devising a plan for the control of the rosette disease in Louisiana: (1) The fact that infection takes place only on the new canes in the spring, (2) the relatively short period during which infection takes place, (3) the effectiveness of Bordeaux spray, and (4) the long growing season in Louisiana. The system of control is a combination of pruning and spraying. All the primocanes (new canes) should be pruned close to the ground about the first week in May. This practice will eliminate all the growth that may have become infected up to this date. Then the new canes that develop after pruning, should be kept sprayed with 4-4-50 Bordeaux until the first week in June. Two to three sprayings at about 10-day intervals should be sufficient. The spraying should be thorough. All the buds, and especially the terminal one, should be completely covered with the spray. Because of the long growing season in Louisiana (the plants usually continue to grow as late as November) the pruning of the early primocanes does not appear to have a weakening effect on the vigor of the plant.

In the section around Franklin where the Youngberry is grown to a considerable extent, the practice followed by most of the growers is to wait until the crop is over (which is about the middle of June), and then mow both old and new growth to the ground. This practice naturally eliminates the rosette disease completely. While this practice of late pruning appears to be very successful in the Franklin area where the plants are grown on deep, heavy, fertile alluvial soil, it is deemed unwise to recommend it for other sections, especially where the plants are grown on less fertile, sandy soils and do not make a very vigorous growth, for it is feared that the late pruning will have a weakening effect on the vines.

Spraying by itself, without the pruning, should be effective in controlling the disease, as our experiments have shown. The only difficulty is that the spraying has to be done during the time that the fruit is beginning to ripen and the berries may become stained with the spray material and lose their market value. For this reason it is recommended that a combination of pruning and spraying be employed. The new canes forming after pruning are short and close to the ground, and can be sprayed with very little effort and with the use of a relatively small amount of spray material.

In the case of the dewberry, which is propagated by layering of the tips of canes, there is rather strong evidence to indicate that layerings of rosette canes will give rise to systemically infected plants. This point is not definitely proved, but as a precaution, tip layerings from rosette canes should not be planted.

Finally, it should be kept in mind that this method of control, while giving excellent results as far as it has been tried, is still in a more or less experimental state. Modifications may be found necessary after the method has been applied in field practice on a large scale.

SUMMARY OF CONTROL MEASURES

1. Do not allow any wild blackberries or dewberries to grow in close proximity (along ditches, fences, etc.) to your berry planting, as the rosette disease will spread from the wild to the cultivated vines.

2. Inspect your planting in the spring and remove any rosette growth that may be present. This will eliminate the source of infection from the immediate vicinity of the plants. This cutting off of the rosette growth should be done early in the spring (preferably in February) before the opening of the blossoms; that is, before the spores of the fungus have been formed.

3. Prune all the new canes to the ground about the first week in May. This will eliminate all the canes that may have become infected up to this period.

4. Spray the new canes that develop from the time of pruning until the first week in June with 4-4-50 Bordeaux. The spraying should be done about every 10 days. Two to three sprayings should be sufficient.

5. Do not plant dewberry plants that come from tip layering of rosette canes.

GENERAL SUMMARY

1. The rosette disease of blackberries and dewberries is described.

2. The causal agent of the rosette disease in Louisiana is apparently an undescribed species of Cercosporella. The disease has been repeatedly produced by artificial inoculations with pure cultures of this fungus.

3. Infection takes place in the spring on the new canes (primocanes). The infected canes grow normally during the summer, exhibiting no external symptoms of the disease, but during the following spring, when growth is resumed, the infected buds give rise to a rosette or witches-broom type of growth. The blossoms from rosette shoots do not set fruit.

4. The period of infection has been determined experimentally. Infection takes place from about the middle of March, when the spores of the fungus begin to form on the diseased blossoms, to about the first week in June. Infection does not occur after this period, even though there is an abundance of spores present on the withered blossoms until the end of August.

5. Bordeaux spray (4-4-50) has been found very effective in controlling the disease if the primocanes are kept sprayed during the period of infection.

6. A plan of control has been devised employing a combination of pruning and spraying. The primocanes are pruned to the ground about the first week in May. This eliminates all the growth that may have become infected up to this time. Then, the new canes forming after pruning are kept sprayed with Bordeaux until about the first week in June, that is until the period of infection has passed. Two to three sprayings at approximately 10-day intervals appear to be sufficient.

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